AN INELASTIC X-RAY SPECTROMETER WITH 2.3 meV ENERGY RESOLUTION

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A new spectrometer at the Advanced Photon Source for inelastic x-ray scattering with an energy resolution of 2.3 meV at an incident energy of 21.6 keV is presented. As a monochromator, two nested channelcuts are used in in-line geometry. The advantage of this approach, compared to a single backreflection monochromator, are a steeper tail of the resolution function and an enhanced tunability and accuracy in performing energy scans. For the energy analysis, a (18,6,0) silicon crystal is used in a backscattering geometry. The analyser consists of a 4 mm thick silicon disk, which is diced into 1 mm large pixels on a glass substrate and then bent to a radius of 6 m. In Fig. 1 a measurement of the resolution function of the spectrometer is shown, which can be obtained with a strong elastic scatterer (e.g. plexi glass at 1 $Å^{-1}$) as a sample. The solid line in Fig. 1 is a fit of a Pseudo-Voigt function with a gaussian part of 53 % and a FWHM of 2.25 meV. The width of the resolution function and the intensity compares well with two similar spectrometers at the ERSF [1], [2]. The Pseudo-Voigt like shape is an improvement with respect to the other spectrometers, which have lorentzian like resolution functions.

To obtain an estimate for the accuray of the energy scale, two branches of the phonon dispersion in a beryllium single crystal were measured and compared to dispersion curves measured with neutrons [3]. As can be seen in Fig. 2, the deviations between the neutron and the x-ray data are typically below 2 %.

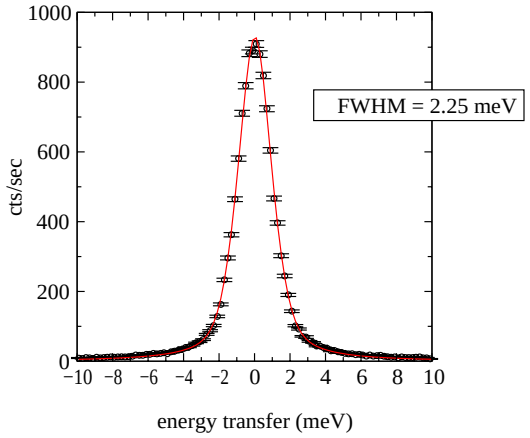

Figure 1: Resolution function measured with a plexi glass sample

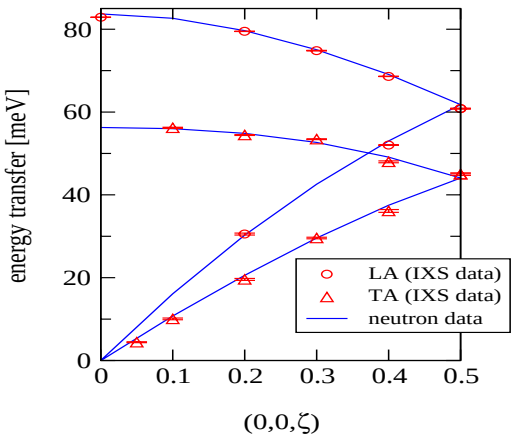

Figure 2: Phonon dispersion in beryllium. Neutron data are taken from [3].

References

[1] see for an overview: E. Burkel, Rep. Prog.Phys. **63** (2000) 171-232

[2] C. Masciovecchio et al., Nucl. Instrum. Methods **B 111** (1996) 181

[3] R. Stedman et al., J. Phys. **F6** (1976) 157

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